Modelling, Dynamic Analysis and Control of Capsubot Systems with Stable Propulsion for Medical and Recovery Assistances

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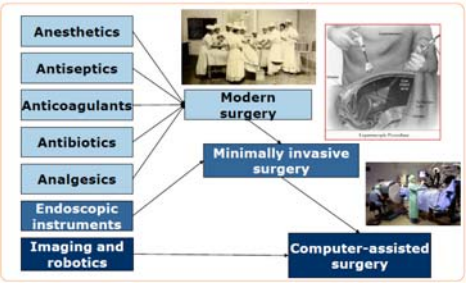
INTRODUCTION

The growth of medical robots since the mid-1980s has been striking. From a few initial efforts in stereotactic brain surgery, orthopaedics, endoscopic surgery, microsurgery, and other areas, the field has expanded to include commercially marketed, clinically deployed systems, and a robust and exponentially expanding research community.

Obscure gastrointestinal (GI) bleeding, Crohn disease, Celiac disease, small bower tumors, and other disorders that occur in the GI tract have always been challenging to be diagnosed and treated due to the inevitable difficulty in accessing such a complex environment within the human body. Robot-assisted minimally invasive surgery has become an choice.



CHALLENGES

Challenges for developing a capsule robot with stable propulsion:

- Modeling
- Controllability and maneuverability
- Propulsion mechanism
- Visualization (quality of pictures or videos)
- Power supply
- Reliability
- Weight and size
- Others

POTENTIAL APPLICATIONS

Nowadays, robots have taken a lot of difficult tasks in many fields and the number of jobs entrusted to robots is growing steadily. The research has vast potential applications including:

- Industrial manipulator
- Medical robot
- Military robot
- Personal transporter
- Space robot

RESEARCH POINTS

Currently my research points mainly focus on the following aspects to design, model and control a capsule robot with hybrid propulsion for medical inspections and assistances:

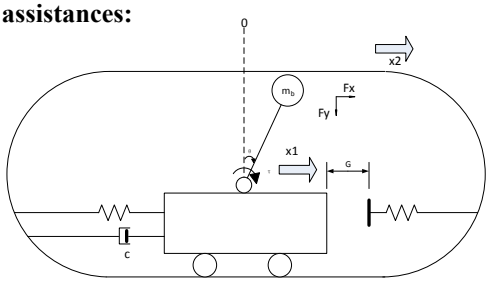


Fig 1: The Proposed Capsule Robot System 1

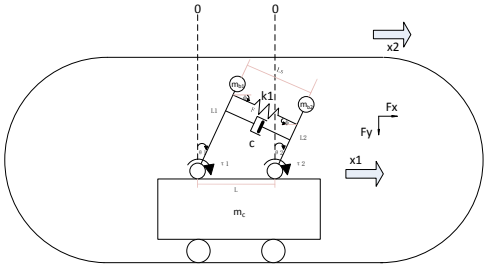


Fig 2: The Proposed Capsule Robot System 2

- Dynamic Modeling
- Intestinal Frictional Resistance Modeling
- Mechanical Efficiency
- Control Techniques (e.g. Fuzzy Contro, Chaos Control)
- Path Planning Algorithms
- Implementations (Simulation and Experimental Works)

CONCLUSION

This research focuses on modelling dynamic analysis and control of capsubot systems with stable propulsion for medical and recovery assistances. This research aims to investigate the proposed capsubot systems from a control point of view, and use it as a benchmark to explore a new control method that can achieve better performance than previous studies. The challenges, prospects and needs will be investigated through intensive literature survey of the capsubot systems. Modelling, dynamic analysis and control of the proposed systems will be conducted via Matlab and some advanced methodologies. The implemented prototype has a potential of extensive applications.

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